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THE PHOSPHOROUS CYCLE IN THE COURSE OF STUDY RELATED TO THE BIOLOGICAL SCIENCES AT VARIOUS LEVEL

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ABSTRACT

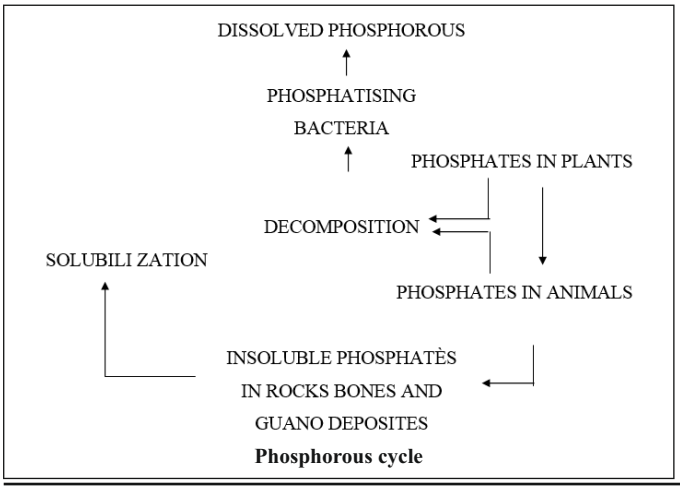
All living (Plants and Animals) maintain inter dependency among them in the environment. In the environment plants waste products are useful for animals and animal waste products are useful for plants. Phosphorous is an essential nutrient for animals and plants. It plays a critical role in cell development and is a key component of molecules that store energy. Phosphorous is a chemical element found on Earth in numerous compound forms such as the phosphate ion (PO43-), located in water soil and sediment. The phosphorous cycle is the component of biogeochemical cycle. It shows the interdependency among all types of organisms. This is also essential knowledge for everybody studying the biology at various levels.

KEYWORDS: Phosphorous cycle, Phosphorus, Phosphate Ions, Regulation.

INTRODUCTION:

Biology is the science of study of all living things and it may be known as life science. All living things are habituating under the earth's biosphere these are atmosphere, lithosphere and hydrosphere. In the atmosphere the livings are habituating in lands to air and water to air. In the lithosphere the animals and plants are living on land. In the hydrosphere the animals and plants are living in water. The phosphorus cycle is the biogeochemical cycle that described the movement of phosphorus through the lithosphere, hydrosphere and biosphere. The atmosphere does not play a significant role in the movement of phosphorous, because phosphorous and phosphorous, based compounds are usually solids at the typical ranges of temperature and pressure found on Earth. The production of phosphine gas occurs in only specialised, local conditions. Therefore the phosphorous cycle should be viewed from whole. Earth system and then specifically focused on the cycle in terrestrial and aquatic systems. Low concentration of phosphorous in soils reduces plant growth, and slows soil microbial growth. Soil microorganism act as both sinks and sources of available phosphorous in the biogeochemical cycle. Human have caused major changes to the global phosphorous cycle through shipping of phosphorous minerals and use of phosphorous fertilizer, and also the shipping of food farms to cities, where it is lost as effluent.

Phosphorous cycle: Phosphorous is an important and necessary constituent of protoplasm, tends to circulate" the organic compounds being broken down eventually to phosphate which are again available to plants. Phosphorous plays an essential role in almost every step of organic synthesis. This element is more abundant in living organisms than in abiotic system. The main reservoirs of phosphorous on earth are living organisms and relatively insoluble calcium phosphate deposits in rock and sediments. Phosphorous is solubilized from its deposits under conditions of low pH and is taken up by plants which puss it on to the food chain. Plant and animal secretions and decomposition of dead organic material bring it back to the surrounding medium. A part of this phosphorous is leached away to oceans through rivers where it forms marine deposits being available to fishes and marine birds which convert it to phosphate rocks, guano-deposits and bone deposits as relatively insoluble tricalcium phosphate. Therefore, only a little amount of phosphorous returns to land from ocean thorough fishes and guano birds while much of it is lost to relatively deep see deposits.

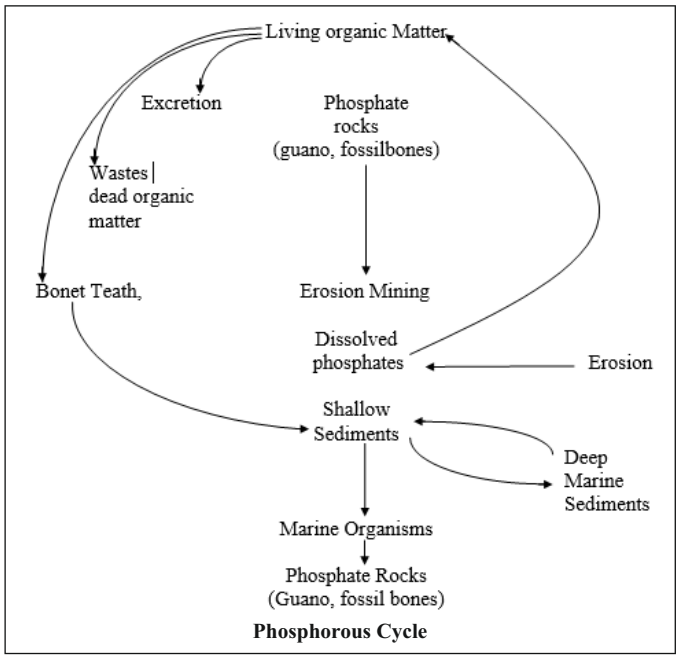


Phosphorous cycle

Phosphorous absorbed by soil organisms in replenished mainly by applied phosphate fertilizers, plant residues and organic wastes. Some part of added phosphate fertilizer becomes rather quickly recycled into the edaphic organic pool, from which it is slowly released through mineralization. The remaining part of Phosphorous becomes distributed, absorbed, or precipitated in the form of orthophosphates of calcium, iron or aluminium.

In freshwater habitats, phosphorous often limits algal production, but this occurs rarely in the sea. Coastal waters contain about to twice as much phosphate as can be used by algae. Marine phytoplankton can concentrate phosphorous by a factor of as much as 10^7 over its concentration in the sea, and prolific algal growth can deplete the phosphorous to very low level indeed.

As a constituent of nucleic acid, phospholipids and numerous phosphorylated compounds phosphorous is one of the nutrients of major for importance to biological systems, the ratio of phosphorous to other elements in organisms tends to be considerably greater than the ratio of phosphorous in the available and primary sources, thus phosphorous becomes ecologically significant as the most likely limiting or regulating element in productivity.



Phosphorous Cycle

Phosphorous: Phosphorous is found in every cell of the human body. An adult human contains about 400-700 g of phosphorous as phosphates; A major part of about 80% of the total is present in combination with calcium in the bones and teeth. About 10% is combined with proteins, lipids and carbohydrates, and other compounds in blood and muscles. The remaining 10% is widely distributed in various chemical compounds. Phosphorous is present in the body as inorganic salts of phosphoric acid or in combination with organic compounds.

(a) Inorganic Phosphorous: Present as calcium phosphate in bones and teeth, and as phosphates of sodium (Na) and potassium (K) in soft tissues or body fluids

(b) Organic phosphorous: Present as:-

(i) Phospholipids (e.g. lecithin, cephalic)

(ii) Nucleoproteins and nucleic acids.

(iii) Creatin phosphate, ATP and ADP and co-enzymes I, H and carboxylase,

(iv) Hexose phosphates, trios phosphate and glucero phosphates,

Impact of human activity on Phosphorous cycle:
Humen intervene in the earth's a phosphorous cycle in following three ways:

(i) Human mine large quantities of phosphates rocks to make commercial inorganic fertilisers and detergents,

(ii) Human reduce the available phosphate in soil by cutting down forests.

(iii) Human disrupt aquatic systems with phosphates from runoff of animal wastes and fertilizers and discharges from sewage treatment systems.

Phosphine Gas: Phosphine is a colourless, flammable, very toxic gas compound with the chemical formula PH3 classed as a priclogen hydride, Pure phosphine is odourless, but technical grade samples have a highly unpleasant odour like ratting fish, due to the presence of substituted phosphine and diphosphane (P2H4) with traces of (P2H4) is present , PH3 is spontaneously flammable in air (Pyrophoric), burning with a luminous fame.

Phosphine is a natural gaseous carrier of phosphorous in its biogeochemical cycles, has been found the ubiquitously present in the environment.

Phosphate Ion: The phosphate or orthophosphate ion (PO43-) is derived from phosphoric acid by the removal of three protons H+, Removal of one or two protons gives the dihydrogen phosphate ion (H2 PO4-) and the hydrogen Phosphate (H2 PO42-) ion, respectively. These names are also used for salts of those anions, such as ammonium dihydrogen phosphate and trisodium phosphate.

In organic chemistry, it is an organophosphate, an ester of orthrophosphoric acid of the forms PO4RR'R" where one or more hydrogen atoms are replaced by organic groups, an example is trim ethyl phosphate, (CH3)3PO4. Orthophosphates are especially important among the various phosphates because of their key roles in biochemistry, biogeochemistry, and ecology, and their economic importance for agriculture and industries. The addition and removal of phosphate groups (phosphorylation and dephosphorylation) are key steps in cell metabolism, orthophosphates can condense to form pyrophosphates. Regulation of Phosphorous Cycle: Unlike carbon, water, and nitrogen, phosphorous is not present in the atmosphere as a gas. Instead, most phosphorous in the ecosystem exists as compounds, such as phosphate ions (Po43-) found in soil, water, sediment and rocks. Phosphorous is often a limiting nutrient. Consequently, phosphorous is added to most agricultural fertilizers, which can cause environmental problems related to runoff in aquatic ecosystem.

Phosphorous is present in many important biological structures DNA cell membranes, bones, and teeth It is found in minerals, sediment, volcanic ash and aerosols. As rocks and sediment weather overtime, they release inorganic phosphate, which gradually reaches soil, and surface water plants absorb and incorporate these phosphates into organic molecules. Animals obtain and incorporate phosphates by consuming plants and other animals when plants and animals die of excrete waste organic phosphates return to the soil and are broken down by bacteria in a process called phosphate minerali -zation - into inorganic forms that can again be used by plants.

Natural runoff can transport phosphates to river, lakes, and the ocean, where they can be ingested by aquatic organisms when aquatic organisms die an excrete waste, phosphorous - containing compounds may sink to the ocean floor and eventually form sedimentary layers. Over thousands of geological uplift can return phosphorous containing rocks from the ocean to land.

The phosphorous cycle is similar to other elemental cycles and is often described in an overly - simplified way : As Earth's tectonic plates shift, volcanic action, earthquakes, and movement at plate boundaries expose buried sediments and rock to the surface of the planet. When exposed to elements like wind and water, mechanical and chemical weathering of these rocks take place. These transformations release phosphates that have been bound in these reservoirs to the environment, where they become available in soil & water. After passing through biological systems via the food chain, phosphorous is eventual returned to the soil and then into aquatic systems, where it ultimately becomes sediment and can move back into the geological part of the cycle. Like all of Earth's cycles, there is no start or finish to the phosphorous cycle, and certainly no single direction of movement. Earth's cycles are complex webs where resources are move in multiple directions. In fact, it might be even easier to think of the phosphorous cycle as being a process made up of a series of smaller processes that may or may not ever interact - processes that take place over a time frame as short as weeks and as long as millennia. To get a better sense of the movement of phosphorous through the lithosphere, biosphere, and hydrosphere it helps to view it in terms of its movement on a shorter time-scale and through a specific ecosystem.

CONCLUSION AND RECOMMENDATION:
Phosphorous is an essential nutrient found in the macromolecules of all living organisms. The phosphorous cycle is slow. Most phosphorous in nature exists in the form of phosphate ions. Phosphorous is often the limiting nutrient, or nutrient that is most scare and thus limits growth in aquatic ecosystem.

In order to maintain a proper balance between the environment and human survival it becomes incorporate concepts of immediate concern that have direct implications not only to theory but practical work and their subsequent application for environmental protection and human survival. This is also significant with the viewpoint to bring out social awareness towards the protection of environment, human survival and then to maintain the ecological balance. Based on the finding obtained from the present study the following recommendations can be advanced since the incorporation of units of atmosphere and its resources plays a significant role in bringing about.

(i) Awareness for maintaining a proper balance among man, plants, animals and phosphorous so that the proper balance between the same may not be disturbed.

(ii) The study of such concepts as phosphorous cycle should be specifically introduced in the course of study related to the biological sciences at various levels.

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